

WHAT IS CLAIMED IS:

1 1. A method of separating CO<sub>2</sub> from a hydrocarbon inlet gas stream that is within  
2 predetermined pressure and temperature ranges, comprising the steps of:

3 (a) subjecting the inlet gas stream to fractional distillation in a distillation column  
4 providing a bottom product stream and a distillation overhead stream;

5 (b) passing the distillation overhead stream from step (a) to a membrane unit  
6 producing a hydrocarbon stream and a by-product stream;

7 (c) passing the hydrocarbon stream from step (b) to a hydrocarbon separator to  
8 separate hydrocarbon liquid having been condensed in said membrane unit from  
9 hydrocarbon vapor; and

10 (d) subjecting the hydrocarbon vapor from step (c) to cooling providing a cooled  
11 hydrocarbon vapor stream that is fed to a reflux drum; and

12 (e) taking a reflux liquid stream from said reflux drum and a hydrocarbon gas  
13 product stream.

1 2. A method of separating CO<sub>2</sub> from a hydrocarbon inlet gas stream according to claim 1  
2 including:

3 passing said bottom product stream from step (a) to a reboiler/separator that  
4 provides a reboiler separator vapor stream directed to a bottom portion of said distillation  
5 column and a hydrocarbon condensate product stream.

1 3. A method of separating CO<sub>2</sub> from a hydrocarbon gas inlet stream according to claim 2  
2 wherein said bottom product stream from step (a) is pumped at increased pressure to said  
3 reboiler/separator.

1 4. A method of separating CO<sub>2</sub> from a hydrocarbon gas inlet stream according to Claim 1  
2 wherein a reflux liquid stream from step (e) is pumped at increased pressure to a top tray  
3 of said distillation column.

1 5. A method of separating CO<sub>2</sub> from a hydrocarbon gas inlet stream according to Claim 2  
2 wherein said bottom product stream from step (a) is heated prior to being passed to said  
3 reboiler/separator.

1 6. A method of separating CO<sub>2</sub> from a hydrocarbon gas inlet stream according to Claim 1  
2 wherein said hydrocarbon liquid stream from said reflux drum is passed through a cross  
3 heat exchanger to heat said inlet gas stream prior to its fractional distillation.

1 7. A method of separating CO<sub>2</sub> from a hydrocarbon gas inlet stream that is within  
2 predetermined pressure and temperature ranges comprising the steps of:

3 (a) subjecting the hydrocarbon gas inlet stream to fractional distillation in a  
4 distillation column providing a bottom product stream and a distillation overhead stream;

5 (b) subjecting said distillation overhead stream of step (a) to membrane  
6 separation, providing a hydrocarbon stream and a CO<sub>2</sub> by-product stream;

7 (c) cooling the hydrocarbon stream of step (b) producing a cold hydrocarbon  
8 stream; and

9 (d) refluxing said cold hydrocarbon stream from step (c) back into said  
10 distillation column.

1 8. A method of separating CO<sub>2</sub> from a hydrocarbon inlet gas stream according to Claim 7  
2 including:

3                    passing said bottom product stream from step (a) to a reboiler/separator that  
4                    provides a reboiler separator vapor stream that is directed to a bottom portion of said  
5                    distillation column and a hydrocarbon condensate liquid product stream.

1    9.        A method of separating CO<sub>2</sub> from a hydrocarbon gas inlet stream according to Claim 8  
2                    wherein said bottom product stream from step (a) is pumped at increased pressure to said  
3                    reboiler/separator.

1    10.       A method of separating CO<sub>2</sub> from a hydrocarbon gas inlet stream according to Claim 7  
2                    wherein said cold hydrocarbon stream from step (d) is pumped at increased pressure to a  
3                    top tray of said distillation column.

1    11.       A method of separating CO<sub>2</sub> from a hydrocarbon gas inlet stream according to Claim 8  
2                    wherein said bottom product stream from step (a) is heated and then passed to said  
3                    reboiler/separator.